Journal of Contemporary Issues in Business and Government Vol. 27, No. 2, 2021
https://cibg.org.au/

P-ISSN: 2204-1990; E-ISSN: 1323-6903
DOI: 10.47750/cibg.2021.27.02.416

Forecasting innovative development of infrastructure providing services to agriculture

SAYYORA NASIMOVNA KHAMRAEVA[1]

[1]Head of the Chair "Innovative Economics" at Karshi Engineering-Economics Institute, Doctor of Economics

Abstract: The article is devoted to the analysis of the innovative development of agriculture and its infrastructure services through mathematical materials and the development of prospects. The results of the multifactor econometric model were developed using statistical data and Eviews software. According to the results of the obtained econometric model, the influence of factors on changes in the volume of infrastructure services provided to agriculture was determined. Also, on the basis of the developed trend models, the forecast parameters of the volume of agricultural infrastructure services, gross agricultural output, the number of machine-tractor parks and zoo-veterinary stations until 2023 were determined.

Keywords: agricultural infrastructure, agriculture, innovation, econometric model, forecasting.

INTRODUCTION

In the context of the current process of global integration, ensuring food security of the country requires that the industry be flexible, adapt to the changing external environment, be influenced by various innovations and scientific and technological progress, based on sustainable agricultural development. Therefore, in many developed countries of the world, the modern stage of agricultural development is described as the stage of transition to an innovative model that provides systematic integration of the agricultural sector and science and technology to increase its efficiency. In particular, "there is a need to create "smart agriculture" in order to optimize production and distribution systems and implement new business models that will allow more efficient use of land, energy and other natural resources, as well as more attention to the needs of the world's poor"[1].

Governments around the world invest heavily in research and innovation. For example, the European Union spends the investment equal to an average of 1.97% of gross domestic product on research and development, and the countries that are members of the Organization for Economic Cooperation and Development spend 2.4% of gross domestic product, respectively.

Finland, Israel, and the Republic of Korea, the leading countries in terms of spending on innovation, account for 3.55%, 4.2%, and 4.36% of gross domestic product, respectively.[2].

LITERATURE REVIEW.

Some scientific-theoretical and organizational-economic aspects of innovative development of various sectors of the economy, including infrastructure serving agriculture, have been studied in the scientific works of foreign economists [D.A.Aschauer, 1989; A. Show,1912; I.Sandu, 2005; B.Santo, 1990; R.Taker, 2006; B.Twiss, 1989; V.F. Fedorenko, 2011; M.Khuchek, 1992.

In particular, the American economist Paul Narcyz Rosenstein-Rodan described the infrastructure as "a set of common conditions, or key areas that meet the needs of the entire population and ensure the development of private entrepreneurship in key sectors of the economy ..."[P.N.Rosenstein-Rodan, 1957.].

In "Theory der infrastructure" (The theory of infrastructure), R. Jochimsen interpreted infrastructure as a set of material, personal and institutional activities and their organizations that contribute to the organization of an integrated economy in the regions [R.Jochimsen, 1966].

Also, since the 1980s, many economists have begun to study issues such as "What will be the cost-effectiveness of the investment in the infrastructure network?", "What is its direction and strength?". At the same time, no one doubted that there was a correlation between infrastructure development and economic development, but it remained unclear how much the infrastructure would have a positive impact on economic growth.

In his research, D.Aschauer noted that investing in infrastructure has a great positive effect [D.Aschauer, 1989]. He estimated the coefficient of elasticity of the volume of production relative to the investment in infrastructure and calculated it as 0.39. That is, a 1% increase in investment in infrastructure will lead to a 0.39% increase in GDP in the private sector.

D.Canning and P.Pedro [D.Canning, P.Pedron, 2008] justified the impact of infrastructure on long-term economic growth on the basis of an econometric model. In general, although not at the level of D.A.Aschauer, research shows that the infrastructure sector has a positive impact on the development and growth of the economy.

In general, a multi-factor econometric model was developed using the least squares method to determine its efficiency based on the innovative development of agricultural service infrastructure. The factors involved in the multifactor econometric model are important in studying the changes in the volume of services in agriculture and their impact on efficiency.

RESEARCH METHODOLOGY

The least squares method was used to determine the impact on the innovative development of agricultural service infrastructure through econometric modeling. The results of the multi-factor econometric model were developed in the Eviews program.

As factors contributing to the multi-factor econometric model - the outcome factor was calculated in 2018 estimates. Volume of agricultural infrastructure services in the Republic of Uzbekistan, mln. soums (Y) and expenditures on technological marketing and organizational innovations in agriculture as factors influencing it, mln. soums (x1), percentage of highly educated specialists in the field of agricultural infrastructure, percent (x2), fundamental research in the field of agricultural sciences performed on its own out of total current expenditures, mln. soums (x3), applied research in the field of agricultural sciences from total current expenditures, million soums (x4), investments in agriculture and livestock, hunting and services, bln. soums (x5). (Table 1).

Table 1:

Appendix 6

Values of factors included in the correlation-regression analysis, at the price of 2018 year[3]

Years	Infrastructure services for agriculture, mln. soums	Expenditures on technological marketing and organizational innovations in agriculture, mln. soums	Proportion of highly educated specialists in the field of agricultural infrastructure, in percent	Fundamental research in the field of agricultural sciences performed on its own out of total current expenditures, mln. soums	Applied research in the field of agricultural sciences performed on its own from the total current expenditures, mln. soums	Investment in agriculture and animal husbandry, hunting and services in these areas, bln. soums
	Y	X1	X2	X3	X4	x5
2007	798745	42,3	14,5	34,7	173,6	200,6
2008	829896	44,5	14,5	38,2	184,8	260,7
2009	880519,7	46,8	15,1	45,2	189,9	385,6
2010	878758,7	34,5	16,1	24,5	538,1	525,5
2011	989482,3	119,7	17,5	31,1	697,1	934,4
2012	981566,4	942,7	17,5	2690,5	13102,2	1077,6
2013	935432,8	3988,2	18,5	3551,1	14638,1	1320,1
2014	942916,2	1841,9	19,1	3998	13236,4	1429,8
2015	968375	1751,7	19,2	4952,8	16671,6	1361,6
2016	959659,6	8144,3	20,8	6474,2	19061,8	1605,7
2017	1017239,2	15685	21,4	6342,3	28876,4	2258,4
2018	996894,4	71,3	16,8	7933,8	31902,8	3463,7

One of the basic rules of constructing a multifactor econometric model is to determine the link densities between the factors selected for the model, i.e. to investigate the problem of multicollinearity of the relationship between the selected factors. For this, the coefficients of correlation are calculated among the factors, x_i and y_i variables – the correlation coefficient –is the most common indicator showing a linear relationship between x and y when accepting values $i = 1,\ldots,n$, which is calculated as follows [I. I. Eliseeva, 2003]:

$$r_{xy} = \frac{Cov(x,y)}{\sqrt{Var(x)}\sqrt{Var(y)}}. \qquad (1)$$

(1) the value $Cov(x,y)$ at the numerator is determined by the following ratio:

$$Cov(x,y) = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y}) \qquad (2)$$

x and y are called covariances of the variables and are found as follows:

$$Cov(x,x) = Var(x), \quad Cov(y,y) = Var(y). \qquad (3)$$

THE OBTAINED RESULTS

The correlation matrix between services in the field of agriculture of the Republic of Uzbekistan and the factors influencing it is calculated as below (Table 2).

Table 2: Correlation matrix of relationships between factors

Selection: 2007 2018						
Number of observations: 12						
	Y	**X1**	**X2**	**X3**	**X4**	**X5**
Y	0.005397					
Correlation	1.000000					
t- Student criterion	-----					
P-value	-----					
X1	0.101519	4.827020				
Correlation	0.628948	1.000000				
t- Student criterion	2.558253	-----				
P- value	0.0285	-----				
X2	0.007390	0.257210	0.015887			
Correlation	0.798098	0.928819	1.000000			
t- Student criterion	4.188707	7.926925	-----			
P- value	0.0019	0.0000	-----			
X3	0.129571	4.345441	0.245265	6.060767		
Correlation	0.716392	0.803397	0.790413	1.000000		
t- Student criterion	3.247006	4.266681	4.080326	-----		
P- value	0.0088	0.0016	0.0022	-----		
X4	0.126135	3.653581	0.222459	5.002704	4.370084	
Correlation	0.821292	0.795489	0.844282	0.972067	1.000000	
t- Student criterion	4.552356	4.151305	4.982008	13.09708	-----	
P- value	0.0011	0.0020	0.0006	0.0000	-----	
X5	0.056513	1.193359	0.084672	1.768122	1.627524	0.696433
Correlation	0.921749	0.650866	0.804974	0.860615	0.932917	1.000000
t- Student criterion	7.516541	2.711065	4.290423	5.344070	8.192747	-----
P- value	0.0000	0.0219	0.0016	0.0003	0.0000	-----

In order to create a multi-factor econometric model on the cost of agricultural infrastructure services and the factors influencing it, all of the above factors are taken and how they behave in the model is examined [I. I. Eliseeva, 2003].

In recent years, the use of nonlinear models has yielded good results. We proposed the use of a hierarchical multi-factor econometric model.

The hierarchical multifactor econometric model looks like this:

$$y = a_0 x_1^{a_1} \cdot x_2^{a_2} \cdot \ldots \cdot x_n^{a_{n1}} \qquad (4)$$

where: y - outcome factor; $x_1, x_2, \ldots, x_n$ - influencing factors.

If we take the substitution by the natural logarithm in model (4), then we get the following:

$$\ln(y) = \ln(a_0) + a_1 \ln(x_1) + a_2 \ln(x_2) + \ldots + a_n \ln(x_n). \qquad (5)$$

If we make $\ln(y) = y'$, $\ln(a_0) = a_0'$, $\ln(x_1) = x_1'$, $\ln(x_2) = x_2'$, ..., $\ln(x_n) = x_n'$ assignments in model (5), then we get the following appearance:

$$y' = a_0' + a_1 x_1' + a_2 x_2' + \ldots + a_n x_n'. \qquad (6)$$

The following system of normal equations is constructed to find the unknown $a_0', a_1, \ldots, a_n$ parameters in the model (6)

$$\begin{cases} n a_0 + a_1 \sum x_1 + a_2 \sum x_2 + \ldots + a_n \sum x_n = \sum y \\ a_0 \sum x_1 + a_1 \sum x_1^2 + a_2 \sum x_1 x_2 + \ldots + a_n \sum x_n x_1 = \sum y x_1 \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ a_0 \sum x_n + a_1 \sum x_1 x_n + a_2 \sum x_2 x_n + \ldots + a_n \sum x_n^2 = \sum y x_n \end{cases} \qquad (7)$$

If this system of normal equations (7) is solved analytically by the Gaussian method or the substitution method, then the values of the unknown $a_0', a_1, \ldots, a_n$ parameters are found.

We use the least squares method to construct and analyze an econometric model between infrastructure services that serve agriculture and the factors that affect it.

Table 3: Multi-factor econometric model results in the Eviews program (Results of a multifactor econometric model.)

Dependent variable: Y				
Method: the least squares				
Selection: 2007-2018				
Number of observations: 12				
Variable	**Coefficients**	**Standard errors of coefficients**	**t- Student criterion**	**P-value**
X1	0.015024	0.022087	1.680189	0.005218
X2	-0.114479	0.407873	-1.280673	0.007884
X3	-0.023300	0.022635	-2.029352	0.003430
X4	0.007373	0.034672	1.212659	0.008386
X5	0.111244	0.052439	2.121399	0.00781
C	13.30946	0.859697	15.48158	0.0000
R2- determination coefficient	0.903555	The average value of the dependent variables		13.74204
R2- Adjusted Coefficient of Determination	0.823185	Standard deviation of dependent variables		0.076734
Standard error of regression	0.032266	DW- Darben Watson criterion		2.497199
F- Fisher criterion	11.24239			
Prob(F-statistic)	0.005261			

With the help of the above substitutions, we write the appearance of an econometric model using the data from Table 3:

$$y = e^{13,3} * x_1^{0,015} * x_2^{-0,114} * x_3^{-,0023} * x_4^{0,007} * x_5^{0,111} \quad (8)$$

When the multivariate regression model (8) was examined by all criterion, it was found that it was statistically significant, that the model parameters were reliable, multicollinear, and that there were no heteroskedastic errors.

As a result, the coefficient of determination R^2, which represents the magnitude of the coefficient, was equal to ***0,904***. This indicates that the outcome factor is sufficiently closely related to the selected factors, that is, agricultural infrastructure services (Y) are 90.4 percent dependent on factors included in the multi-factor econometric model. The remaining 9.6 percent is due to factors not taken into account.

Typically, the determination coefficient takes values at the intersection [0; 1]. The closer the value of the coefficient is to 1, the stronger the correlation. The fact that the coefficient of determination, in this case, is equal to ***0.904*** value that there is a sufficiently strong correlation between these economic indicators in the model. An adjusted determination coefficient is usually used to be able to compare the models with a different number of factors and to ensure that these quantitative factors R^2 do not affect the statistics [Dimitrios Asteriou and Stephen G. Hall, 2007], that is:

$$R^2_{текис} = 1 - \frac{s^2}{s_y^2} \quad (9)$$

In this case, the coefficient of this leveled determination should be equal to the value of ***0,823***, and its proximity to R^2 means that the change in the number of factors affecting the model will take values around.

We use Fisher's F-criterion to determine the statistical significance of the constructed multifactor econometric model and its relevance to the process under study. The actual value of the F-criterion is calculated using the following formula [I. I. Eliseeva, 2003]:

$$F_{хисоб} = \frac{R^2}{1-R^2} \cdot \frac{n-m-1}{m}, \quad (10)$$

where: R^2 - coefficient of determination;
n - number of observations;
m - number of factors.

The actual value of the F-criterion is F_{count} = 11.242. If the actual value is greater than the value in the table, then the constructed multi-factor econometric model is called to be statistically significant or adequate to the process being studied.

We find the table value of the F-criterion. To do this, we calculate the values according to the degrees of freedom $k_1 = m$ and $k_2 = n - m - 1$ and α significance. Assuming the degree of significance $\alpha = 0{,}05$ and the degrees of freedom k_1=5 and k_2=12-5-1=6, the table value of the F-criterion is F_{table}=4,39.

F_{count}>F_{table} condition is acceptable, and it is statistically significant because the calculated value of the F-criterion is greater than the value in the table, which can be used to forecast future infrastructure services for agriculture.

The Student's *t*-criterion is used to verify the reliability of the parameters and correlation coefficients of the multifactor econometric model (8). In this case, their values are compared with the values of random errors [I. I. Eliseeva, 2003].

$$t_b = \frac{b}{m_b}; \quad t_a = \frac{a}{m_a}; \quad t_r = \frac{r}{m_r}. \qquad (11)$$

Random errors in the econometric model parameters and correlation coefficients are calculated according to the following formulas [I. I. Eliseeva, 2003]:

$$m_b = \sqrt{\frac{\sum(y-\hat{y}_x)^2/(n-2)}{\sum(x-\bar{x})^2}} = \sqrt{\frac{S_\sigma^2}{\sum(x-\bar{x})^2}} = \sqrt{\frac{S_\sigma}{\sigma_x\sqrt{n}}}; \quad (9)$$

$$m_a = \sqrt{\frac{\sum(y-y_x)^2}{(n-2)} * \frac{\sum x^2}{n\sum(x-\bar{x})^2}} = \sqrt{S_\sigma^2 \frac{\sum x^2}{n^2\sigma_x^2}} = S_\sigma \frac{\sum x^2}{n\sigma_x} \qquad (12)$$

$$m_{r_{xy}} \sqrt{\frac{1 - r_{xy}^2}{n-2}}. \qquad (4.13)$$

By comparing the Student's t-criterion (t_{count}) and table values(t_{table}), we accept or reject the H_0 hypothesis. To do this, we find the table value of the t-criterion based on the selected probability of reliability (α) and the degree of freedom ($\text{d.f.} = n - m - 1$) conditions. Here, n - is the number of observations, m - is the number of factors.

When the probability of reliability is $\alpha = 0{,}05$ and the degree of freedom is d.f.=12-5-1=6, then the table value of *t* –criterion equals to t_{table} =2,4469.

The |t_{count}|> t_{table} condition must also be satisfied for the calculated parameters in the multi-factor econometric model for agricultural infrastructure services.

We use the Darbin-Watson (DW) criterion to check the autocorrelation in the residuals of the resultant factor on the model (8) [Dimitrios Asteriou and Stephen G. Hall, 2007]:

$$DW = \frac{\sum_{t=2}^{T}(e_t - e_{t-1})^2}{\sum_{t=1}^{T} e_t^2} = \frac{\sum_{t=2}^{T} e_t^2 + \sum_{t=2}^{T} e_{t-1}^2 - 2\sum_{t=2}^{T} e_t e_{t-1}}{\sum_{t=1}^{T} e_t^2} =$$

$$= 2 - 2\frac{\sum_{t=2}^{T} e_t e_{t-1}}{\sum_{t=1}^{T} e_t^2} \approx 2(1 - \rho_1), \qquad (14)$$

Here, ρ_1 - is a correlation coefficient of the first order.

If there is no autocorrelation among the residuals of the resulting factor, $DW = 2$, in a positive autocorrelation DW tends to zero, and in a negative autocorrelation tends to 4.

$$\begin{cases} \rho_1 = 0 \rightarrow DW = 2; \\ \rho_1 = 1 \rightarrow DW = 0; \\ \rho_1 = -1 \rightarrow DW = 4. \end{cases}$$

The calculated DW is compared with the DW in the table.
If there is no autocorrelation in the residuals of the resulting factor, then the value of the calculated DW criterion will be around 2. The value of the DW criterion calculated in this example is 2.5. This indicates that there is no autocorrelation from the resulting factor residues.
According to the obtained econometric model (8), the cost of technological, marketing and organizational innovations in agriculture can increase by 1%, while the volume of infrastructure serving agriculture can increase by 0.015% if other factors do not change. The share of highly educated specialists in the field of agricultural infrastructure may increase by 1%, while the volume of agricultural infrastructure may decrease by 0.114% if other factors do not change. In the field of agricultural sciences, a 1% increase in total current expenditures on fundamental research can reduce the volume of infrastructure providing services to agriculture by 0.023%, unless other factors change. The volume of applied research in the field of agricultural sciences can increase by 0.007% from the total current expenditures of applied research, if other factors do not change. Investment in agriculture and animal husbandry, hunting and services in these areas may increase by 1%, while the volume of infrastructure services in agriculture may increase by 0.111% if other factors do not change.
The study also identified the impact of changes in the dynamics of infrastructure on the volume of gross agricultural output.

Table 4: Values of factors included in the correlation-regression analysis, at the price of 2018 (1 Data of the Ministry of Agriculture and the State Statistics Committee of the Republic of Uzbekistan.)

Years	Gross agricultural output, bln. soums	Number of infrastructure facilities, unit			
		Alternative car tractor park (ACTP)	Mineral fertilizer sales branches	Zooveterinary	Information consulting
	Y	X_1	X_2	X_3	X_4
2002	77248,8	95	87	1	2
2003	82888	222	213	40	16
2004	90265	518	339	79	30
2005	95139,3	812	546	175	103
2006	101513,7	1431	801	306	221
2007	107706	1723	882	386	261
2008	112552,8	1777	928	2278	300
2009	119080,8	1757	935	2385	300
2010	127297,4	1720	917	2540	301
2011	135699,1	1715	1381	2560	292
2012	145198	1647	1366	2591	318
2013	155071,4	1641	1357	2591	341
2014	165771,4	1520	1204	2512	201
2015	177043,8	1431	1084	2480	80
2016	188728,7	1336	853	2484	53
2017	192314,6	1663	866	2606	59
2018	192699,2	1363	679	2479	45

Using the data in Table 4, we constructed a straight-line model using the least squares method. We obtained the results of a multifactor econometric model in the Eviews program (Table 5)

Table 5: Multivariate econometric model results in Eviews program

Dependent variable: Y				
Method: smallest squares				
Selection: 2002 2018				
Number of observations: 17				
Variable	**Coefficients**	**Standard errors of coefficients**	**t-Student criterion**	**P-value**
X1	33.88802	11.38871	2.975581	0.0116
X2	50.56186	17.59852	2.873074	0.0140
X3	16.40952	4.492469	3.652673	0.0033
X4	-296.9612	39.71852	-7.476644	0.0000
C	69326.95	8149.037	8.507380	0.0000
R2- determination coefficient	0.942015	The average value of the dependent variables		133306.9

R2- Adjusted Coefficient of Determination	0.922687	Standard deviation of dependent variables	39526.88
Standard error of regression	10990.53		
F- Fisher criterion	48.73781	DW- Darben Watson criterion	1.947209
Prob(F-statistic)	0.000000		

Using the data in Table 4 using the above substitutions, we write the view of the econometric model:

$$y = 69326{,}95 + 33{,}89X_1 + 50{,}56X_2 + 16{,}41X_3 - 296{,}96X_4 \qquad (15)$$

When the multivariate regression model (15) was examined by all criterion, it was found that it was statistically significant, that the model parameters were reliable, multicollinear, and that there were no heteroskedastic errors.

Using the Eviews program, we determined the elastic coefficients of model 15 (Table 6).

Table 6: Elasticity coefficients of parametric results of a multifactor empirical model

Selection: 2002 2018		
Number of observations: 17		
Variable	**Coefficients**	**Elasticity coefficient**
X1	33.88802	0.334526
X2	50.56186	0.322128
X3	16.40952	0.206316
X4	-296.9612	-0.383025
C	69326.95	0.520055

Discussion. According to the established coefficients of elasticity, as a result of an increase in the number of alternative machine and tractor fleets in the country by 1%, the gross agricultural output may increase by 0.33%, provided that other factors do not change. As a result of a 1% increase in the number of mineral fertilizers selling branches, the gross agricultural output may increase by 0.32% if other factors do not change. As a result of a 1% increase in the number of veterinary stations, the gross agricultural output may increase by 0.2% if other factors do not change. As a result of an increase in the number of information and consulting offices operating in the country by 1%, the gross agricultural output may decrease by 0.38%, provided that other factors do not change. However, these branches should help introduce innovations in agriculture. However, according to the observations, the activity of information and consulting offices is not satisfactory. At present, these branches are mainly engaged in assisting in the preparation of business plans or the preparation of annual reports. Due to the unsatisfactory performance of these branches, in 2018 compared to 2013, the number of these branches decreased by 296.

In the process of the research, the prospective indicators of the number of infrastructure services rendered to agriculture (at the price of 2018 year), the volume of gross agricultural output (at the price of 2018 year), the number of alternative car tractor parks and the number of zooveterinary offices were determined. A trend model was developed on each indicator.

Using the obtained trend models, we will determine the forecast parameters of the number of infrastructure services rendered to agriculture (at the price of 2018 year), the volume of gross agricultural output (at the price of 2018 year), the number of alternative machine tractor parks and zoometerials for 2019-2024 years (Table 7).

Table 7: Trend models of agriculture and its serving infrastructure services

№	**Indicators**	**Trend models**	**R^2**
1.	Volume of agricultural infrastructure services (at the prices of 2018)	$y=425{,}05t^3 - 10226t^2 + 86399t + 708430$	$R^2 = 0{,}8551$
2.	Gross agricultural output (at the prices of 2018)	$y = 7771{,}9t + 63360$	$R^2 = 0{,}9858$
3.	Number of alternative car tractor parks (ACTP)	$y=0{,}1904t^4 - 5{,}4625t^3 + 26{,}094t^2 + 311{,}43t - 371{,}23$	$R^2 = 0{,}9412$
4.	Number of zoo-veterinary stations	$y=0{,}7046t^4 - 27{,}366t^3 + 335{,}36t^2 - 1158{,}9t + 1008{,}9$	$R^2 = 0{,}9338$

According to the forecast, the volume of infrastructure services for agriculture in 2024 compared to 2018 (in comparable prices in 2018) will be 1262.05 billion soums, which is expected to increase by 26.6%. In addition, the volume of gross agricultural output (in comparable prices in 2018) amounted to 242113.7 billion soums, the number of alternative car and tractor parks increased by 44.6% and the number of zoo-veterinary stations increased by 27.3% (Table 8).

Table 8: Prospects for agriculture and its infrastructure services

Years	Volume of infrastructure services for agriculture (at the prices of 2018), mln. soums	The volume of gross agricultural output (at the prices of 2018), bln. soums	Number of alternative car tractor parks (ACTP), units	Number of zoo-veterinary branches, units
2018	996894,4	192699,2	1363	2479
2019*	1019850,0	203254,2	1819	2844
2020*	1043025,7	211026,1	2312	2912
2021*	1075590,9	218798	3059	2978
2022*	1120634,9	226569,9	4117	3040
2023*	1181553,7	234341,8	5547	3099
2024*	1262050,0	242113,7	7415	3155
Changes in 2024 compared to 2018, in percent	126,6	125,6	544,0	127,3

*** - forecasted indicators**

Increasing the number and type of infrastructure facilities serving agriculture will have a positive impact on improving the competitive environment in the industry and the quality of services.

In order to modernize and accelerate the development of agriculture in the State Program of the President of the Republic of Uzbekistan “Year of Active Entrepreneurship, Support of Innovative Ideas and Technologies” it is important to address the following tasks:

– increasing the volume and efficiency of agricultural production;
– increasing the volume, type and efficiency of infrastructure services in the agricultural sector;
– development of storage and processing of agricultural products on the basis of innovative technologies;
– establishment and rapid development of agroholdings, agroclusters and intersectoral cooperatives (associations);
– further development of financing and lending systems;
– introduction of innovations and innovative technologies in production and their effective use.

It should be noted that Uzbekistan has all the opportunities for innovative development of agriculture and infrastructure facilities serving it. In particular, the average growth rate of agriculture since 2000 is 6%, the adoption of a number of legal and regulatory documents for innovative development, the introduction of new techniques and technologies in agriculture.

In 2017-2021, more sustainable development and competitiveness of the sector will be ensured through widespread introduction of innovative technologies in production, ensuring the integration of science and industry, increasing the domestic and export potential of the industry, deepening the diversification of production in agricultural reform and innovative development of infrastructure activities.

REFERENCES

1. https://www.wipo.int/pressroom/ru/articles/2017/article_0006.html // Globalniy innovatsionniy indeks 2017 g.: v reytingax lidiruyut Shveysariya, Shvetsiya, Niderlandi, SSHA i Soyedinennoye Korolevstvo.
2. Analytical report December 2014. Annual monitoring of funds allocated from the federal budget to finance R&D (including in priority areas of innovative development in Russia)
3. Rosenstein-Rodan P.N. Notes on the theory of the «Big Push». Camb., 1957.
4. Jochimsen R. Theory der infrastructure. Tubungen, 1966.
5. Aschauer, D. A. Is Public Expenditure Productive? // Journal of Monetary Economics. – 1989. №23. – P. 177-200.
6. Canning, D. and Pedroni, P.The effect of infrastructure on longrun economic growth. – 2004. // The Manchester School –2008 №76, P. 504-527.
7. Dimitrios Asteriou and Stephen G. Hall. Applied econometrics. A modern approach using Eviews and Microfit. Revised edition. Palgrave Macmillan, New York, 2007. – p.397.
8. Econometrics: A Textbook. / Under edition I. I. Eliseeva. - M .: Finance and statistics, 2003.
9. Aschauer D.A. Is PublicExpenditure Productive? // Journal ofMonetary Economics. – 1989. №23. – P. 177-200.;
10. Show A. Some Problems in Market Distribution.Quarterly Journal of Economics, XXVI August 1912. – P. 703-765.;

11. Такер Р. Инновации как формула роста: новое будущее ведущих компаний (пер. с англ. Анкудинова А.), 2006, – С.240.;
12. Портер М. Международная конкуренция: Пер. с англ./ Под ред. В.Д.Щетинина. – М.: Международные отношения, 1993, – С. 64.;
13. Твисс Б. Управление научно – техническими нововведениями: сокр. пер. с англ./ Авт. предисл. и науч. ред. К.Ф. Пузыня. – М.: Экономика, 1989. – С 31.;
14. Портер М., Брайт Ж, Твисс Б, Санду И.С. Проблемные вопросы инновационного развития АПК. – М.: РосАКО АПК, 2005, – С 5-6.;
15. Санто Б. Инновация, как средство экономического развития: Пер. с венг./ Общ. ред. и вступ. ст. Б.В.Сазонова. – М.: Прогресс, 1990. – С. 296;
16. Хучек М. Инновация на предприятии и их внедрение. – М.: Луч, 1992 г.;
17. Федоренко В.Ф. Научно-информационное обеспечение инновационного развития в сфере сельского хозяйства: науч. изд. – М.: ФГБНУ "Росинформагротех", 2011. – С. 368.;
18. Khamraeva, S. N. "Analysis of trends and trends in innovative development of agriculture." J. Scientific e-journal of economics and innovative technologies.
19. Khamraeva S. N. Methodological foundations of innovative development of agricultural infrastructure //Journal of Management Value & Ethics. – 2018. – Т. 8. – №. 1. – С. 10-17.
20. Khamraeva S. N. The role of infrastructure in the socio-economic development of agriculture in the context of anti-crisis measures //Regional features of mitigating the effects of the global financial and economic crisis in Uzbekistan. Proceedings of the Republican scientific-practical conference.–Termez. – 2014. – С. 182-184.